



UNIVERSITI PUTRA MALAYSIA

**FACTORS AFFECTING CONSTRUCTION SPEED OF
INDUSTRIALIZED BUILDING SYSTEM IN MALAYSIA**

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**FACTORS AFFECTING CONSTRUCTION SPEED OF INDUSTRIALIZED
BUILDING SYSTEM IN MALAYSIA**

By

WA'EL ABDULMOGHNI MOHAMMED AL-AGHBARI

**Thesis Submitted to the School of Graduated Studies, University Putra Malaysia, in
Fulfillment of Requirement for the Degree of Master of Science**

June 2005



DEDICATION

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

To My Beloved Family

- *To My Kind Parents: Who Provided Me Generously With Advice, Kindness, and Tenderness*
- *To My Excellent Brothers: Who Are My Good Example And Real Supporters*
- *To My Nice Wife: My Journey Mate in Life*
- *To My Lovely Children: Where I See My Promising Future*

Abstract of thesis presented to the Senate of University Putra Malaysia in fulfillment of the requirement for the degree of Master of Science

FACTORS AFFECTING CONSTRUCTION SPEED OF INDUSTRIALIZED BUILDING SYSTEM IN MALAYSIA

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June 2005

Chairman : Associate Professor Mohd. Razali Abd. Kadir, Ph.D.

Faculty : Engineering

Malaysia is presently taking a serious look at IBS as an answer to the housing shortage problem. There are many advantages using the IBS according to a report published by the Malaysian Ministry for Local Government and Housing. The main advantages are the speed of construction, quality and price. All of these are required to meet the large demand for housing.

This thesis presents the speed of construction methods which are the conventional system, cast-in-situ method, composite methods, and the Industrialized Building System; including the factors that affect the speed of IBS and the factors causing delay in building construction projects.

The data were collected through mailing questionnaires distribution. The questionnaire took into consideration the factors on sample size, time, speed and causes of delay. The questionnaire was distributed to four hundred and fifty respondents among developers, government boards, main contractors, consultants and manufactures who were concerned with the building systems of construction projects in Malaysia. The return was seventy eight respondents.

The statistical descriptive analysis was used to identify whether the respondents have the necessary sufficient qualification to respond correctly to the questionnaire. However, spearman correlation analysis was used to find out the significant scenario of the construction method. The Logit linear analysis was used to choose between the IBS and the conventional methods. In addition, it is used to test these hypotheses since it is a useful mean of both summarizing the results of data analysis and comparing the effects of different speed factors on the probability to choose the construction method. The results have been analyzed to rank the factors affecting the speed of IBS and the factors causing the delay of building construction projects.

As a result from the analysis, it was observed that the full-prefabricated method was the fastest construction method compared to the other methods. Moreover, the high productivity of structural elements (in-situ or off-situ) is the most important factor that had an effect on the speed of IBS. The study also revealed many factors causing delay in building construction projects in Malaysia. These factors could be financial from both the contractors and the owners' side. Poor

management is also an important factor causing delay. However, a very important factor for the delay could be from the consultant's side where the supervision is conducted at a very late stage during the execution of the project and the incompetence in giving timely instructions. Finally, the most important external factor causing delay is the lack of materials in the market.

The result of the study is that there should be continuous improvement of the IBS which focus mainly on innovating techniques to improve the productivity. The financial support as well as technical support is very necessary and urgent for building construction projects.

Abstrak tesis yang di kemukakan Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

**FAKTOR YANG MEMBERI KESAN KEPADA KELAJNAN PEMBINAAN
DALAM SISTEM BINAAN BERINDUSTRI (IBS) DI MALAYSIA**

Oleh

WA'EL ABDULMOGHNI MOHAMMED AL-AGHBARI

Jun 2005

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Malaysia, pada masa kini, sedang meneliti Sistem Pembangunan Industri (IBS) sebagai jalan untuk mengatasi masalah kekurangan perumahan. Menurut laporan yang dikeluarkan oleh Kementerian Perumahan dan Kerajaan Tempatan, terdapat banyak kebaikan Sistem Pembangunan Industri ini. Di antara kebaikan utama sistem ini adalah pembinaan yang pesat, kualiti dan harga, yang kesemuanya adalah diperlukan untuk memenuhi permintaan yang tinggi terhadap perumahan.

Thesis ini menyampaikan kaedan kelajuan pembinaan, iaitu melalui sistem konvensional, kaedah "cast-in-situ", kaedah komposit, dan juga sistem binaan berindustri (IBS), termasuk factor yang memberi kesan kepada kelajuan sistem

binaan berindustri dan juga factor yang menyebabkan kelewatan di dalam projek pembinaan bangunan.

Data kajian ini dikumpul melalui temuduga dan soal selidik. Walau bagaimanapun, kaedah utama pengumpulan data adalah melalui soal selidik. Soal selidik untuk kajian ini mengambil kira faktor-faktor berkenaan saiz sampel, masa, kepantasan dan penyebab kelewatan. Soal selidik telah dihantar kepada empat ratus lima puluh responden di serata lokasi di Malaysia.

Analisis statistik deskriptif telah digunakan untuk mengenal pasti sama ada responden-responden mempunyai kelayakan yang secukupnya untuk menjawab soal selidik kajian ini. Analisis korelasi Spearman turut digunakan untuk mengetahui senario kaedah pembinaan yang signifikan. Analisis logit linear telah dijalankan untuk memilih di antara IBS dan kaedah pembinaar konvensional. Selain daripada itu, analisis logit linear turut digunakan untuk menguji hipotesis kerana kaedah ini boleh memberi ringkasan keputusan analisis data dan memberi perbandingan kesan ke atas faktor-faktor kepantasan yang berbeza dalam memilih kaedah pembinaan. Keputusan kajian akan menyenaraikan faktor-faktor mempengaruhi kepantasan IBS dan faktor-faktor penyebab kelewatan projek pembinaan.

Hasil daripada analisis data, kajian ini mendapati bahawa kaedah pasang siap adalah kaedah pembinaan yang terpanjang berbanding dengan kaedah-kaedah

pembinaan yang lain. Produktiviti struktur elemen (in-situ dan off-situ) yang tinggi turut didapati sebagai faktor yang paling penting dalam mempengaruhi kepantasan IBS. Kajian ini juga telah mengenal pasti faktor-faktor utama yang menyebabkan kelewatan projek pembinaan di Malaysia. Faktor-faktor ini termasuklah faktor kewangan kedua-dua pihak kontraktor dan pemilik. Pengurusan yang tidak cekap turut menjadi faktor penting yang menyebabkan kelewatan. Pihak pakar runding turut menyumbang kepada kelewatan projek di mana pengawasan dan penyeliaan hanya dilakukan pada peringkat terakhir pelaksanaan projek dan arahan yang terlalu lambat. Faktor luaran yang paling penting dalam mempengaruhi kelewatan projek pembinaan adalah kekurangan bekalan di pasaran. Keputusan kajian ini mendapati bahawa terdapat keperluan untuk pembaikan berterusan IBS yang seharusnya memfokus kepada membangunkan inovasi teknik-teknik untuk meningkatkan produktiviti. Sokongan kewangan dan teknikal turut diperlukan dan adalah amat penting dalam pelaksanaan projek pembinaan.

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I certify that an Examination Committee met on 25th April 2005 to conduct the final examination of Wa'el Abdulmoghni Mohammed Alaghbari on his Master of Science thesis entitled "Factors Affecting Construction Speed of Industrialized Building System in Malaysia" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

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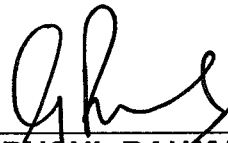
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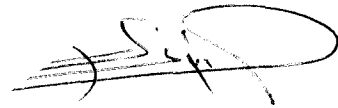


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DECLARATION

I hereby declare that this thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



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Date: 10/ 8/ 2005

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CHAPTER I

INTRODUCTION

1.0 General

In Malaysia, it has been found that there are many types of industrialized building systems (IBS), which are useful for wide range of specific use, but none of them is applicable to all construction sites. They are dependent upon and influenced by many other aspects of the housing situation such as land use, density, volume, environmental conditions, user needs, continuity of demand and labour (Badir, 1998).

Chen, (2000) and Lew, (2003) stated that between the years 1995 to 2020, Malaysia will need a total of 8,850,554 houses, including 4,964,560 units of new housing to cater for increase in population during this period. Unfortunately, only 1,382,917 units were constructed under the 6th (1991-1995) and 7th (1996-2000) Malaysia Plan. Another 3,581,643 units have to be built within the next twenty years. That is, on average 1,790,820 units to be built for every ten years. It is clear that unless a drastic change of policy pertaining to population growth is adopted, or some new solution for this increase housing demand is implemented, the housing problem is expected to continue for years to come. While the problem of housing grows more acute, Malaysia is struggling to meet its own housing needs by increasing application of advanced technology. The

conventional construction method is not able to meet the demand, due to the slow pace of construction and higher cost (Agus, 1997).

Malaysia is presently taking a hard look at IBS as an answer to the housing shortage problem. The main advantages of using IBS according to a report published by the Malaysian Ministry for Local Government and Housing (National Housing Department, 1997) are; speed of construction, quality, and economic advantage, all of which are required to meet such a large demand for housing (Badir and Kadir, 2002).

1.1 Industrialized Building Systems (IBS)

As Malaysia progressively marches towards industrialization, the role of the building industry is greatly enhanced with the idea to transform the aspirations and needs of the people into reality. There is thus an urgent need to mass produced quality housing, affordable to all Malaysians. New and innovative approaches and technology in the design and construction of houses are needed to enable the nations to achieve this target (National Housing Department, 1997). In the Malaysian context of the government's policy on housing is that, the traditional building practices must be replaced by industrialized Building System (IBS), which could save on labour, cost and time of construction and confers quality and durability.

Prefabrication is a key towards increasing building ability. However, pre-cast concrete components and prefabricated reinforcement are still not commonly used in the private sector (Tan, 1997).

A clear understanding of the current status of IBSs will help to set the housing programs under the 8th Malaysia Plan. However, the first step in any advance study on building systems and its technology should be initiated by knowing the status quo (Badir and Kadir 2002).

There are many types of IBSs existing in Malaysia; formwork, precast load-bearing wall panel, precast frame, precast floor and hollow core slab, sandwich, block panel, and steel frame. These IBSs represent most of the IBSs that are exit worldwide. Quality, speed of construction, and cost savings are the main advantages of these systems. These factors are very important in implementing the Seventh Malaysia plan. The main disadvantages of the IBSs in Malaysia are that they are highly capital intensive and there is a need for experts at the construction site for some of them. The main reason to recommend the use of IBSs in Malaysia is that the raw materials used in the IBSs can be produced locally in order to overcome the shortages that are being faced by the IBSs construction industry (Badir and Kadir, 2002).

Almost all the IBSs in Malaysia are suitable for all numbers of storeys, especially for three to five storey buildings. At the same time, all the classes of construction

from the unit cost point of view, which are arranged from low-cost house class to high-cost house class.

1.2 Speed and saving time in construction projects in Malaysia

The quality, speed of construction, and cost saving are the main emphases given in the building construction industry in Malaysia

Malaysia is a rapidly developing country in the Asian region, with its economy heavily dependent on agriculture, forestry, petroleum and more recently, manufacturing. Malaysia had undergone rapid economic growth since the 70s. In 1996, the Malaysian economy expanded at more sustainable pace, following a period of rapid expansion in the previous eight years. The gross domestic product (GDP) in 1996 registered a slower growth of 8.5% when compared with the 1995 figure which had a growth rate of 9.6%. The key sector that contributes to the continuous growth is manufacturing, which recorded a double-digit growth, while the service and construction sectors are also expected to perform better than the national average growth (Chan, 2001).

The Malaysian construction industry is undergoing a transitional change from an industry employing conventional technologies to a more systematic and mechanized industry employing the latest computer and communication technologies. This is vital for the future health of the industry, given the trend towards global competition and the advent of the K-economy (Ali, 2000).

Malaysia first experimented with the idea of industrialized prefabrication system in early 1960's. The then minister of Housing and Local Government visited several European countries to study and evaluate their IBS. All of them were impressed by the potential benefits of industrialized prefabrication systems. Din, (1994) identified some of the potential benefits as follow;

- Saving in time if there is proper planning and effective management in its implementation.
- Saving in cost, given sufficient number of units to minimize the amortization cost of capital equipment and faster turnover in funds.

Malaysian government in 1964 identified two pilot projects in order to try out the industrialized prefabrication system. The first of these projects was in Kuala Lumpur about 3,000 units of low cost and 40 shops. The second pilot project was in Pulau Pinang about 3,699 units and 66 shops. After the completion of the two pilot projects, an evaluation was done to compare the advantages and disadvantages of industrialized system with conventional systems in terms of cost, speed of construction, labour requirement and quality control. The result of the evaluation of speed was as follows:

- Both projects took 27 months to complete, inclusive of the time taken in setting up the precasting factories. The construction period was comparable to the fastest conventional construction. Thus industrialized building has lived up to its claim of fast construction. Generally, the

industrialized building has the following advantages in terms of time saving (Din, 1994):

1. Saving of time and materials involved in the erection of scaffoldings.
2. Shorter construction time as a result of well planned and coordinated sequence of construction.
3. Not affected by weather condition as building components are manufactured in the factory, and there is no on-site concreting.